

Report to
Mr. Perry Simons

EPA Region 5 Records Ctr.



385556

ELYSIAN LANDFILL
HYDROGEOLOGIC STUDY

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ELYSIAN LANDFILL HYDROGEOLOGIC STUDY

Introduction

In August of 1972, we were retained by Mr. Perry Simons to investigate the effect of a proposed landfill in Elysian, Minnesota, on that town's municipal well. In addition, the possibility of landfill leachates reaching nearby lakes was also checked.

The proposed Elysian Landfill is located in the east part of the town in a marsh area. Specifically, the site is in the East $\frac{1}{2}$ of the Southeast $\frac{1}{4}$ of Section 35, T 109N, R24W, in LeSueur County. At the closest point, the landfill will be 550 feet from the existing Elysian municipal well.

Topography and Geology

Elysian is located in an area having many small lakes, swamps and marshes. The surface topography is hilly and rolling and is the result of morainic deposition during the Wisconsin glacial period. This glacial till likely covers soil deposits of the previous Kansan glacial period which are surface deposits to the east. A broad valley generally runs towards the east from Elysian and has been formed by the Cannon River during and after the Wisconsin glacial period.

The uppermost bedrock layer in the area is the Platteville Limestone Formation. This Formation occurs at a depth of 287 feet below the ground surface (Elevation 1092) at the municipal well. The log of soils and bedrock at the well was obtained from the Minnesota Department of Health and is from a driller's log. The bedrock aquifer used for water supply is the St. Peter Sandstone which is located 294 feet below the ground surface at the well.

The St. Peter Sandstone is a good source of water supply and is used extensively by both private homes and municipalities to the south and east of Elysian. In this area, the formation is approximately 120 feet in thickness and dips to the southeast. It is separated from the underlying Prairie du Chien Group by shale layers at its base. To the

~~north and west of Elysian, the St. Peter Sandstone has been removed and~~
the uppermost bedrock layer is the Prairie du Chien Group and at some locations further north, the Jordan Sandstone.

Existing Groundwater Conditions

The groundwater conditions consist of two separate elements, the glacial drift groundwater and the water under pressure in the St. Peter Sandstone.

It is apparent from the topographic maps that the Elysian area has a high glacial drift groundwater table. The numerous lakes and marshes are surface expressions of the groundwater and the levels in adjacent land areas should be reasonably close and probably higher than the lake levels. In the area of the landfill, the groundwater levels were assumed to be at elevation 1021.

The St. Peter Sandstone is a confined or artesian aquifer in the Elysian area as it is throughout most of southern Minnesota. This means that the water in the sandstone is under pressure and when the formation is tapped by a well, the water will rise above the top elevation of the layer. Data from the Elysian well indicates that the static water level in the well is at elevation 997 or 199 feet above the top of the St. Peter Sandstone. Water under pressure in bedrock aquifers seldom is static but is moving due to variations in water pressures. Well records indicate that the pressure head on the St. Peter Sandstone is considerably higher to the south and east. Therefore, the St. Peter water will flow to the north or northwest in the Elysian area. The pressure gradient causing this flow is estimated from well records as approximately six (6) feet per mile.

The landfill is in a recharge area for the St. Peter Sandstone. This is indicated by the fact that the glacial drift groundwater levels are at a higher elevation (1021) than the St. Peter Sandstone pressure head (997). However, this situation exists over the entire south central part of the state where the only real discharge areas are along the Minnesota and possibly the Blue Earth Rivers.

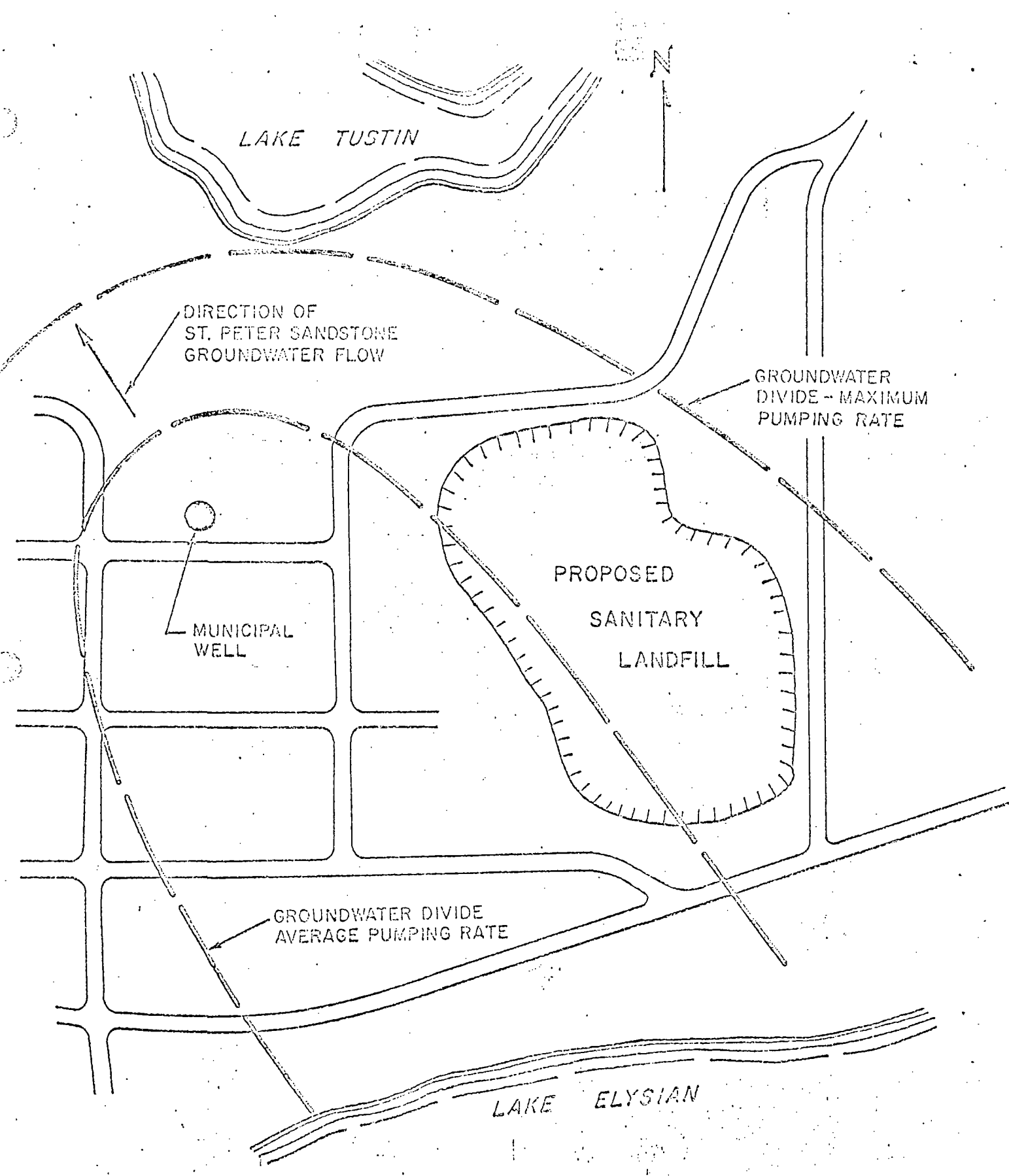


FIGURE 2
ELYSIAN LANDFILL
ZONES OF WELL INFLUENCE

SCALE: 1" = 300'

G. M. SUNDE

Zone of Well Influence

A pressure gradient exists generally to the north or northwest in the St. Peter Sandstone. Therefore, determining the zone of well influence becomes a solution for a well located in an area of confined uniform flow. The following assumptions were used in the analysis:

1. The gradient of flow to the north is 6 feet per mile. This gradient is based on existing St. Peter well records in the area.
2. Permeability of the St. Peter Sandstone was assumed to be 20 feet per day. This is based on pumping records for the Elysian municipal well.
3. Thickness of the St. Peter Sandstone was assumed to be 120 feet.
4. Well pumping rates used were 9250 cubic feet per day (maximum) and 3750 cubic feet per day (based on 60 gallons per capita per day).

Figure 1 shows the area influenced by the municipal well for the two pumping rate assumptions. The groundwater divides shown mark the separation between water in the St. Peter Sandstone which will flow to the well and that which will continue to flow north. Note that for the maximum pumping rate, the landfill will be completely within the zone of influence. For the average rate, whether or not the landfill is in the zone of influence depends on the direction of flow in the St. Peter Sandstone. The direction shown in Figure 1 is north-northwest, however there is no assurance that the flow will not be more westerly.

Downward Seepage Analysis

The previous computation showed that the landfill is possibly within the zone of influence of the Elysian municipal well. If it is, the soil through which downward seepage must pass could provide some degree of treatment and also control the rate of seepage downward to the St. Peter Sandstone.

There are two subjective proofs for limitations on the amount and quality of water which moves downward. First of all, the entire town of

Elysian is presently using individual sewage disposal systems. These systems will add considerable sewage effluents to the groundwater and, if the soil is pervious, should have caused contamination years ago at the municipal well. Test results of groundwater at the Elysian well do not show unusually high values for chlorides, nitrates, or other indicators of pollution from cesspools and drainfields.

Secondly, the considerable thickness of overlying soils and bedrock should retard downward seepage and also provide a high degree of treatment for the landfill leachates. Morainic soils are generally intermixed and do not have continuous layers of granular soils which would conduct seepage downward. If Kansan drift does exist beneath the site, it would be greatly preconsolidated due to presence of the ice overburden during the Wisconsin glaciation. The municipal well boring log also identifies 7 feet of Platteville Limestone over the St. Peter Sandstone. Normally a seal exists at the base of the Platteville Formation due to the presence of the Glenwood Shales. If these shales are in place, additional protection against downward seepage is provided.

Seepage to the Adjacent Lakes

The low area in which the landfill will be developed is at approximately elevation 1021. Water table observations indicate that the groundwater is at the surface. The United States Geological Survey quadrangle map entitled Elysian, Minnesota, indicates that the surface elevation of Lake Tustin is 1019. The control elevation of Lake Elysian is 1017. Therefore an elevation difference of two feet in 500 feet exists to the north and four feet in 500 feet exists to the south. Our computations indicate that groundwater flow does not now occur from the marsh area to the lakes but rather groundwater divides exist in the land areas between the marsh and the lakes. These computations used the assumption that the soils were glacial tills with the most permeable being silty sands. If more permeable soils exist in these areas, seepage could exist towards the lakes.

When the landfill is constructed, there is a possibility that the water table could rise within the fill and gradients towards the lakes could be established. Depending on the soil types in the land area between

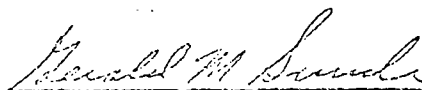
the fills and the lakes, resultant seepage may not be a problem. However if extremely granular non-cohesive soils exist in these areas, leachates of measurable strength could reach the lakes.

Summary

The principal drawback to this landfill location is the close proximity to the Elysian municipal well. The general nature of the groundwater conditions in the St. Peter Sandstone Formation in this area are known. However, this information is not detailed enough so that an exact idea of the direction of groundwater flow can be determined. If we assume a northerly groundwater flow and average well pumping rates, the landfill will be outside of the zone of influence of the well. However, the direction of flow could as easily be in a northwesterly direction, pumping rates could increase, and the landfill would be within the zone of influence.

If the landfill is within this zone, leachates in small quantities may reach the well depending on the vertical permeability and uniformity of the glacial drift. Water quality tests for the well indicate no unusual contamination due to the drainfields and seepage pits now being used for sewage disposal in the town. Considerable treatment of the leachates will occur during their downward travel to the St. Peter Formation. It is quite possible that testing of the municipal well using normal parameters will not indicate the presence of leachates should the landfill be constructed.

I hereby certify that this report was prepared by me and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.



Gerald M. Sunde

Date: October 16, 1972 Reg. No. 8734

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Le Center, Minnesota 56057

PHONE 357-2278

June 27, 1972

File
~~*See Serial*~~
RECEIVED
JUN 29 1972
MINN. POLLUTION
CONTROL AGENCY

Minnesota Pollution Control Agency
717 Delaware S.E.
Minneapolis, Minnesota

Re: Village of Elysian, Minnesota

Gentlemen:

The Village of Elysian advertised for bids for garbage pickup but was compelled to refuse and reject all bids submitted. It will accordingly be an additional thirty days before they will be in a position to comply with the Pollution Control Act, which requires all dumps to be closed by July 1st. Kindly consider this letter as an application for a variance for thirty days until such time as we can re-advertise and enter into a Contract for a garbage pickup.

Very truly yours,

HEINEN & CHRISTIAN

W. L. Heinen
By: W. L. Heinen

WLH:lmg